We claim:

1. Sample preparation apparatus comprising a support, a microscope, a pattern-recognition assembly and a milling laser coupled to the support, and a sample of interest.

2. The apparatus of claim 1, wherein the pattern-recognition assembly is a computer-operated integrated pattern recognition for automatically addressing specific locations on the sample.

3. The apparatus of claim 1, wherein the laser is a femto-second laser for milling a desired pattern on a portion of interest of the sample.

4. The apparatus of claim 3, wherein the microscope is an optical microscope, and further comprising a holder for the microscope, and a precision micro-manipulator engaging the support for extracting and positioning the portion on the holder.

5. The apparatus of claim 1, wherein the sample is silicon wafer.

6. The apparatus of claim 4, wherein the sample comprises a substrate forming a membrane support for protecting the portion extracted from the sample by laser ablation.

7. The apparatus of claim 6, further comprising a focused ion beam source or FIB for thinning the sample, and a transmission electron microscope or TEM for analyzing the sample, and a bracket for supporting the TEM and FIB.

8. The apparatus of claim 7, wherein the portion removed by the laser is a shaped block comprising an area thinned for the

TEM and guide holes on the block for mounting to the bracket.

9. The apparatus of claim 8, wherein the area is a thin layer between two large ends of the block having a supporting blade on a top side.

10. The apparatus of claim 8, further comprising probes mounted on the bracket for mating with the holes on the block and for holding the block on its side on the bracket, and twin stylus on the bracket for engaging and lifting the block from the sample, transferring to the holder for thinning with the FIB and transferring to the TEM for inspection and analysis without contamination of the block.

11. A sample preparation method comprising providing a sample wafer of interest on a support, cutting and extracting a desired nano-level portion from the wafer with a laser, holding and protecting the portion with a holder, placing the portion inside a FIB, thinning an area of interest on the portion with the FIB, and transferring the portion with the area of interest to a TEM and analyzing the portion with the TEM.

12. The method of claim 11, wherein the extracting comprises extracting the portion <u>in situ</u>.

13. The method of claim 11, wherein the providing the sample comprises providing a wafer stage platform for the sample, and selecting the area of interest with an optical microscope.

14. The method of claim 13, further comprising automatically addressing specific locations of the area of interest on the wafer selected by the optical microscope with a

computer operated pattern recognition assembly connected to the optical microscope.

15. The method of claim 14, further comprising milling the wafer with the laser attached to the optical microscope, wherein the milling comprises milling a desired pattern of the area of interest of the wafer.

16. The method of claim 15, wherein milling the desired pattern comprises forming a thin sample strip with ends and holes and then cutting the portion as a block from the wafer.

17. The method of claim 15, wherein the milling comprises milling with a femto-laser for minimizing thermal damage caused by laser ablation.

18. The method of claim 16, further comprising moving the sample wafer with a micro-manipulator during the laser milling and the cutting.

19. The method of claim 18, wherein the moving comprises moving the laser during the laser milling and the cutting.

20. The method of claim 18, wherein the moving comprises moving the support during the laser milling and the cutting.

21. The method of claim 18, wherein the moving comprises moving an arm with dual stylus of the micro-manipulator, engaging ends of the milled portion, extracting the cut block from the wafer, placing the block in a TEM holder tip of a TEM holder.

22. The method of claim 21, further comprising finishing and thinning the sample strip by an FIB.

23. The method of claim 22, further comprising rotating the

block by about 90° with the TEM holder and transferring the block to a TEM for analysis.

24. The method of claim 23, further comprising turning the area of interest on its edge, inspecting and analyzing the area of interest with the TEM.

25. The method of claim 16, wherein the milling the block comprises forming a block of desired shape containing the sample strip in a selected area, forming the sample strip thinner than the block, and inspecting the sample strip with a TEM.

26. The method of claim 25, further comprising laser-drilling guide holes on ends of the block for picking up by an arm or bracket with dual stylus and using a substrate of the block for protecting the thin sample strip taken from the area of interest of the wafer.

27. The method of claim 26, further comprising fitting FIB and TEM instruments on the bracket for automatically receiving the block without any contamination.